AN ANALYSIS OF THE CATCH BY TRAWLERS IN MORETON BAY (QLD.) DURING THE 1966–67 PRAWNING SEASON

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Synopsis

A study of the trawling industry in Moreton Bay during the 1966–67 season suggests that the catch rate of prawns by trawl had not changed significantly since the early years of the industry. Neither was there evidence of a decline in the fishery in Moreton Bay for winter whiting (*Sillago maculata* Quoy and Gaimard), the only commercial fish taken regularly by trawl in large numbers.

Rates of capture of prawns and incidental fish were determined. The results, extrapolated to the activities of the prawning fleet in Moreton Bay, indicated a total seasonal catch of 1·8–2·1 million lb of prawns, and 1·6–1·9 million lb of incidental fish, including 0·17–0·20 million lb of winter whiting. An example of the catch composition of incidental fish caught during the sampling period is provided.

INTRODUCTION

The trawling industry in Moreton Bay began in 1950, when a four-fathom otter trawl was tested to ascertain the possibility of fish and prawn capture on a commercial basis by this method. In the following year about 40 boats were operating at the height of the season. Interestingly, a survey carried out at that time by the Department of Harbours and Marine led to the conclusion that " the operations of prawn trawlers are not detrimental to the stocks of immature food fishes ". The total prawn catch in Moreton Bay for the 1952–53 season was estimated at 300,000 lb, and in 1953–54 was 500,000 lb. By 1962 the total Queensland prawn catch was 4·4 million lb, over half of which was from Moreton Bay (Annual Reports of the Queensland Department of Harbours and Marine, 1950–62). The catch has fluctuated since to the 1966–67 season, when 1·8 million lb of prawns were received at Fish Board depots from both inside and outside the bay (Queensland Fish Board Report, 1967).

The number of trawlers operating in Moreton Bay varies seasonally. A total of 249 trawler licences were issued in the Brisbane district for the 1966–67 season. Of these, trawlers not licensed to work outside the bay numbered about 30, but most of the remainder trawled to a greater or lesser extent in Moreton Bay during the prawning season, September to February inclusive.

Since the Fish Board records do not distinguish between prawns taken inside Moreton Bay and those taken in grounds outside and adjacent to the bay, the quantity taken in neither area is known. Also, the quantity of incidental fish taken by the trawlers has not been previously determined. This study was carried out to ascertain the rate of catch of prawns and incidental fish and, by extrapolation of the data, to estimate their total seasonal quantities taken by the prawning fleet.

METHODS

Data used in this survey were obtained during October and November, 1966, and March, 1967, in the University of Queensland research vessel, a 37-foot trawler using an eight-fathom otter trawl with a 1·5 in mesh cod-end, towed at an estimated 2·5 knots. Most commercial trawlers operate at this speed.

Trawling was carried out at night with the commercial prawning fleet. Areas being worked changed frequently, depending on several factors, including weather, phases of the moon, tides, but was often simply a matter of follow the leader. If prawns were scarce in one area the fleet moved elsewhere such that no specific areas could be compared. However, by following the fleet a reasonable indication was obtained of their catches of fish and prawns.

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It was assumed that all fish captured were killed by the trawling procedure. From observations, many are dead before the net is emptied on to the sorting tray, where they remain during the sorting process, which may take up to an hour. It was apparent that only isolated individuals survive the trawl and subsequent exposure.

For the estimation of total seasonal trawling time, the following parameters, derived chiefly by observations and discussions with fishermen, were used.

(*a*) Season. The bay season generally extended from September to February inclusive, although prawning continued at a significant level until the end of May, after which it was considered uneconomical to trawl. An influx of trawlers occurred during the period December to February inclusive, the " peak " of the season.

Table 1

Estimated and Actual Weights of Trial Trawls in Moreton Bay, September, 1966

No.	Estimated Weight (lb)	Actual Weight (lb)
1	24	21
2	16	18
3	3	4
4	11	10
5	16	18
6	20	23
7	31	36
8	20	23
9	9	9
10	25	28

(*b*) Number of boats. From September through November the average number of trawlers working the bay was normally 50 ; in the " peak " months it swelled to between 150 and 200, after which the number of vessels dropped to about 30, tailing off to the end of prawning in May.

(*c*) Time spent trawling. Allowing for times when the net is out of the water, the time spent trawling each night is 10 hours. Moreton Bay is open to trawling five nights a week, but the average weekly period worked appeared to be three and one-half nights, bad weather and maintenance accounting for the remaining time.

(*d*) Gear. The trawling gear in use in Moreton Bay is almost without exception the otter trawl ; most nets are the legal minimum mesh size and maximum width of 1·5 in and eight fathoms, respectively. The average net width was taken to be seven fathoms to account for small trawlers not capable of towing the large nets.

From these parameters, a trawler may average 1,050 fathom-hours trawling each month.

In early samples both fish and prawns were weighed. However, trawler operators are usually adept at estimating the weight of a catch by its volume, and it was found in this case that the skipper of the research vessel was giving fairly reliable visual estimates of the weight of prawns in a basket and of fish on the sorting tray. Accuracy of his estimates was confirmed by a series of 10 trial hauls made under commercial prawning conditions. Table 1 shows the hauls which were first estimated and subsequently weighed by machine. A *t* test showed no significant difference between trial estimates and actual weights at the 0·05 level of probability.

Winter whiting, the only commercial fish species taken regularly in large numbers, and prawns were separated and weighed. Weights of the remaining incidental fish were visually estimated. Prawns were further divided into the two commonly used gradings made by professional prawners ; " large ", which includes large king (*Penaeus plebejus* Hess) and tiger (*Penaeus esculentus* Haswell) prawns, with which are sometimes found smaller quantities of the endeavour prawn (*Metapenaeus endeavouri* (Schmitt)), and " small " or " mixed bay prawns ", which include small individuals of the above species as well as other species, especially the greentail prawn (*Metapenaeus bennettae* Racek and Dall). More complex size and species groupings are sometimes made by fishermen to obtain the most economically valuable yield.

RESULTS

1. *Catch rates.* The catch rates of prawns and incidental fish during the sampling period are shown in Table 2, and those of whiting in Table 3. Results are expressed in terms of weight per hour per fathom of net, since these units have most relevance to bay prawning.

TABLE 2

Catches and Catch Rates of Fish and Prawns by Weight in Trawls in Moreton Bay during October and November, 1966, and March, 1967

Period	Total Trawl Duration (hr)	Total Weight (lb)	Weight/Hr/ Fathom
(*a*) *Incidental fish*			
October, 1966	28·6	348	1·53
November, 1966 ..	27·8	419	1·89
March, 1967	7·0	149	2·66
(*b*) *Large grade prawns*			
October, 1966	28·6	367	2·0
November, 1966 ..	27·8	296·5	1·66
March, 1967	7·0	71	1·58
(*c*) *Small grade prawns*			
October, 1966	28·6	119·5	0·57
November, 1966 ..	27·8	85	0·38

TABLE 3

Catch Rate of Winter Whiting during the 1966–67 Sampling Period in Moreton Bay

Period	Weight/Hr/ Fathom (lb)
October, 1966 ..	0·17
November, 1966 ..	0·23
March, 1967	0·14

2. *Estimation of total seasonal prawn and incidental fish catch.* On the basis of the seasonal parameters described earlier, it was possible to estimate the total catches of the Moreton Bay prawning fleet in 1966–67. These estimates are contained in Table 4, where lower and upper values were obtained using a figure of 150 and 200 trawlers respectively, for the number of boats trawling at the height of the season, December through February. Estimates for the period September to February are based on the October and November, 1966,

samples, while those for the period March to May are based on the March, 1967, data. No data were obtained for the catch rate of small grade prawns in the latter samples and their catch rate was assumed similar to that during October-November.

TABLE 4

Lower and Upper Estimates of the Total Weights of Fish and Prawn Capture by Trawlers in Moreton Bay during the 1966–67 Prawning Season

Period	Estimated Weight (lb)	
	Lower	Upper
(a) *Incidental fish*		
September–February	1,356,000	1,626,000
March–May	267,300	
Total	1,623,300	1,893,300
(b) *Large grade prawns*		
September–February	1,274,600	1,528,400
March–May	131,300	
Total	1,405,900	1,659,700
(c) *Small grade prawns*		
September–February	333,600	400,600
March–May	45,400	
Total	379,000	446,000

3. *Analysis of the incidental fish catch.* Complete analysis of the fish catch was not attempted, but it was clear from earlier observations that only one commercial species, the winter whiting, was being taken by trawlers in constantly large numbers. From Tables 4 and 5 the whiting comprised approximately 10% by weight of the total incidental fish catch. The only other commercial fish species encountered in large numbers was the snapper (*Chrysophrys auratus* Bloch and Schneider), schools of which were sometimes trawled near reefs. Those taken in the net were always less than 4 in long.

TABLE 5

Lower and Upper Estimates of the Total Weight of Winter Whiting Catch by Trawlers in Moreton Bay during the 1966–67 Season

Period	Estimated Weight (lb)	
	Lower	Upper
September–February	158,200	189,700
March–May	13,500	
Total	171,700	203,200

Catches of other commercial species were generally in negligible quantity, including flathead (*Platycephalus* spp.), sole (*Achlyopa nigra* (Macleay) and *Paraplagusia guttata* (Macleay)) and golden pilchard (*Engraulis australis* (Shaw)). Isolated specimens of tailor (*Pomatomus saltator* (Linnaeus)), tusk fish (*Choerodon* spp.), sand whiting (*Sillago ciliata* McCoy) and mullet (*Mugil* spp.) were also taken during trawls in the present study.

The bulk of incidental fish, however, were non-commercial or “ trash ” fish species, usually less than 4 in in length, particularly cardinal fish, mainly

Apogon fasciatus fasciatus (Shaw) and less commonly *A. atripes* (Ogilby). These were the most frequently occurring species. But large numbers of silverbelly (*Gerres ovatus* (Gunther)), striped catfish (*Plotosus anguillaris* (Bloch)) and leatherjackets, mainly *Monacanthus oblongus* (Schlegel) and *M. oblongus otisensis* (Whitley), and rarely *M. chinensis* (Osbeck) were sometimes captured.

Species composition and quantities varied greatly from trawl to trawl of equal duration and an average or typical catch was not determined. However, a collection was made of all trawls on one night, 16th November, 1966, over an area of about five square miles east-south-east of Mud Island, in depths of from three to six fathoms. Trawling duration was 7 hours and 45 minutes. The catch composition is shown in Table 6. Species are arranged in order of numbers captured, and the percentage biomass of each is also given.

TABLE 6

Species Composition of 1,511 Fish Weighing 56 lb 9 oz Trawled in Moreton Bay on 16th November, 1966

Common Name	Species	No.	Percentage No.	Percentage Biomass
Cardinal fish	*Apogon* spp.	415	27·6	12·4
Striped catfish	*Plotosus anguillaris* (Bloch)	173	11·5	13·6
Squire*	*Chrysophrys auratus* (Bloch and Schneider)	173	11·5	6·1
Leatherjackets	*Monacanthus* spp.	140	9·3	5·2
Silverbelly	*Gerres ovatus* Gunther	73	4·8	7·4
Goatfish	*Upeneus tragula* Richardson	70	4·6	3·7
Flounder*	*Pseudorhombus* spp.	68	4·6	4·8
Bullrout	*Centropogon marmoratus* (Gunther)	60	4·0	1·2
Puttynose	*Polydactylus multiradiatus* (Gunther)	53	3·5	8·8
Golden pilchard*	*Engraulis australis* (White)	50	3·3	3·6
Winter whiting*	*Sillago maculata* Quoy and Gaimard	40	2·7	5·8
Smooth toad	*Spheroides* sp.	30	1·9	7·8
Sole*	*Cynoglossus* spp. and *Achlyopa nigra* (Macleay)	25	1·7	1·3
White pilchard	*Hyperlophus translucidus* McCulloch	22	1·4	<0·1
River perch	*Johnius australis* (Gunther)	21	1·4	6·3
Bullseye	*Priacanthus macracanthus* Cuvier and Valenciennes	17	1·1	3·7
Dragon fish	*Callionymus* and *Parapegasus* spp.	14	0·9	0·3
Grey catfish	*Euristhmus lepturus* (Gunther)	10	0·7	2·6
Grinner	*Saurida* spp.	8	0·6	1·4
Angler fish	*Antennarius striatus* (Shaw and Nodder)	8	0·6	0·4
Trumpeter	*Pelates quadrilineatus* (Bloch)	8	0·6	0·3
Sixpence	*Leiognathus moretoniensis* Ogilby	6	0·5	<0·1
Flathead*	*Platycephalus* spp.	5	0·3	0·8
Scorpionfish	Unidentified Scorpaenidae	4	0·3	<0·1
Tailor*	*Pomatomus saltator* (Linaeus)	3	0·2	<0·1
Shovelnose shark	*Aptychotrema banksii* (Muller and Henle)	1	<0·1	1·3
Weever	*Parapercis nebulosus* (Quoy and Gaimard)	1	<0·1	0·2
Yellow-tail pike	*Sphyraena obtusata* (Cuvier)	1	<0·1	0·2
Fantail herring	*Harengula* sp.	1	<0·1	0·1
Beardie	*Anacanthus barbatus* (Gray)	1	<0·1	0·1

* Denotes commercial species or genus which includes commercial species.

DISCUSSION

The 1967 report of the Queensland Fish Board gave a total quantity of prawns landed at Moreton Bay fish depots[†] from trawlers working inside and/or outside the bay, of 1,796,108 lb during the 1966–67 season. In addition to these depots, there is a privately owned processing company which accepts prawns from trawlers. In the 1966–67 season, a total of 277,434 lb of large king and tiger prawns and 235,388 lb of mixed bay prawns were landed there from trawlers working *inside* Moreton Bay. A further 400,000 lb of prawns from outside the bay were also landed there.

[†] These depots are at Brisbane, Cleveland, Doboy Creek, Sandgate, Scarborough, and Wynnum (Fig. 1). A Southport depot, at which only trawlers operating outside Moreton Bay land prawns, is excluded.

The grand total 1966–67 prawn catch for trawlers working out of depots other than Southport is thus 2·7 million lb. Moreton Bay prawns make up 55% of the total receivals of the private processing company, and if a similar proportionality is assumed for Fish Board landings, then approximately 1·5 million lb of prawns were taken from Moreton Bay in 1966–67.

This estimate is somewhat lower than the quantity estimated in the present investigation, 1·8–2·1 million lb. In this regard it is interesting to note that the Department of Harbours and Marine, in its 1967 Report, indicated that 1966–67 was one of the worst seasons on record. Reasons given included a depression in the general level of catches, an emigration of trawlers northward, especially to the new, rich grounds in the Gulf of Carpentaria, fewer trawlers from New South Wales moved into the bay, prevailing weather hampered fishing operations, and parts of the bay were closed to prawning for three months (September to November inclusive).

The applicability of empiric catch rates to the prawning fleet also depended on other factors which could not be evaluated, including differences in the efficiency of trawling gear and skill of individual operators.

Comparison can be made, however, with the level of catches in the early years of the fishery. Data are available for the average monthly catches of prawns in Moreton Bay by trawlers during 1952–53 and 1953–54 (Table 7).

TABLE 7

Average Monthly Landings of Prawns by Weight per Boat in the 1952–1953 and 1953–54 Prawning Seasons in Moreton Bay

(Source: Annual Report, Department of Harbours and Marine, Queensland, 1953 and 1954)

(*a*) 1952–53

1952		1953	
Month	Weight Prawns (lb)	Month	Weight Prawns (lb)
July	599	January	2,985
August	505	February	2,898
September	566	March	2,407
October	767	April	1,838
November	635	May	1,439
December	1,090	June	1,466

(*b*) 1953–54

1953		1954	
Month	Weight Prawns (lb)	Month	Weight Prawns (lb)
July	810	January	4,279
August	1,268	February	1,406
September	1,334	March	2,035
October	1,578	April	2,594
November	2,780	May	2,249
December	2,142	June	683

From Table 7, the average annual catch per boat was 17,195 lb in 1952–53 and 23,518 lb in 1953–54. From the present estimates, the average catch per boat for the nine-month season of 1966–67 was 20,586 lb. It seems likely, then, that the rate of prawn capture in the 1966–67 season was of the same order of magnitude as it was in the early phase of the industry. This suggests that the industry has not reached the state of over-fishing, as sometimes claimed by fishermen, especially if 1966–67 was considered a bad year for prawning.

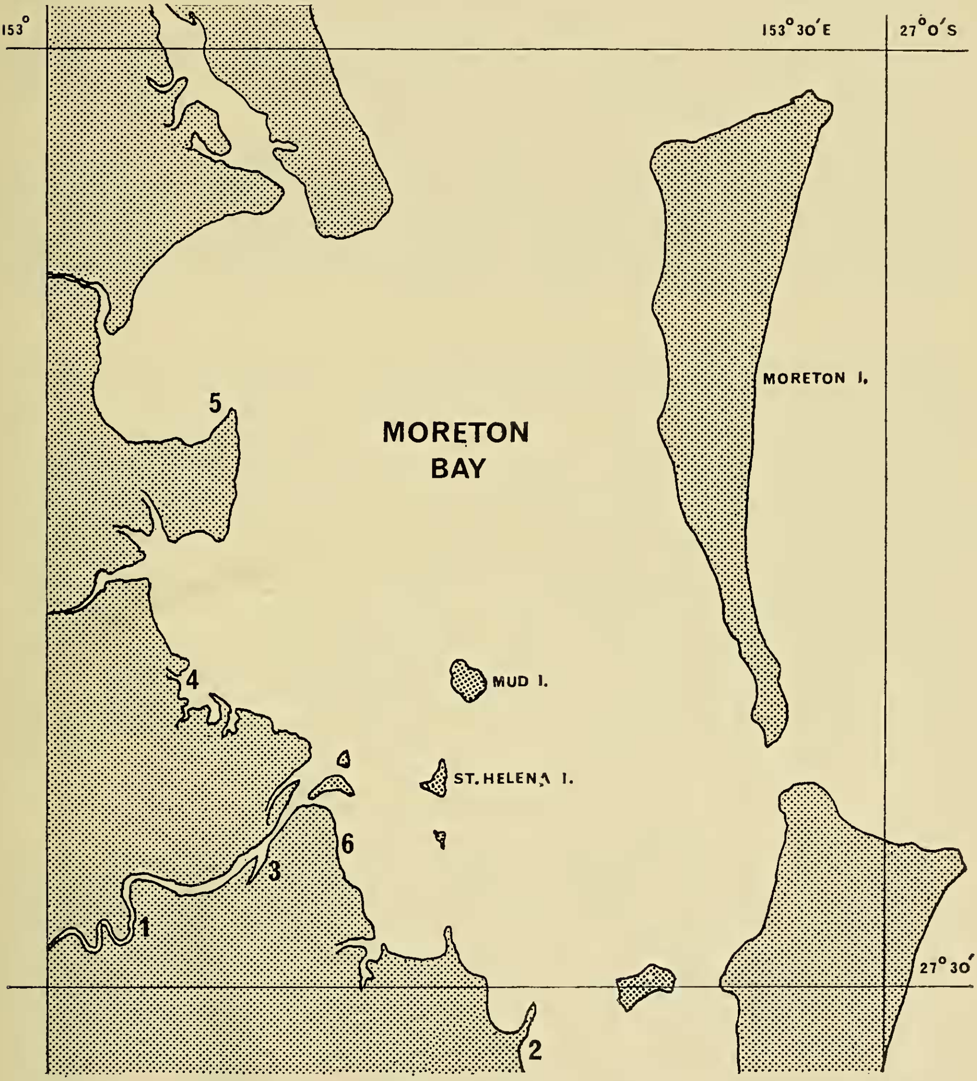

Fig. 1.—Moreton Bay, showing the locations of the Fish Board depots. 1—Brisbane; 2—Cleveland; 3—Doboy Creek; 4—Sandgate; 5—Scarborough; 6—Wynnum.

The incidental fish catch of Moreton Bay prawning has not been investigated in the past, but the ecological implications of the quantities involved, estimated at 1·6–1·9 million lb annually, certainly warrant further attention.

Winter whiting mortality due to trawling in Moreton Bay of an estimated 0·17–0·20 million lb annually, seems an alarming quantity, especially since the great majority of the fish are less than the legal size of capture of 8 in. On the other hand, this species reaches maturity at a somewhat smaller size, and appears to spawn several times each year (unpublished data).

There is no evidence of a decline in the winter whiting fishery in the bay. Individual catches by anglers of several hundred fish per day were not uncommon in 1966–67, and many anglers remembered similar catches over the 16 years that trawling had been carried out in Moreton Bay.

The commercial seine net fishery for whiting includes two species, winter whiting and sand whiting (*S. ciliata* McCoy). The latter species forms the greater part of the annual catch, although the actual proportions are unknown, since they are boxed together and no separate market records are kept. However, the fact that there is no sign of a decline in this fishery is further indirect evidence of the state of the whiting stocks in the bay.

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